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(54) Title: SYNERGISTIC INSECTICIDE MIXTURES			
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(57) Abstract			
The invention relates to insecticide mixtures of fipronil and agonists or antagonists of nicotinic acetyl choline receptors for the protection of technical materials and plants.			
(57) Zusammenfassung			
Die Erfindung betrifft Insektizide Mischungen aus Fipronil und Agonisten bzw. Antagonisten von nicotinergen Acetylcholinrezeptoren zum Schutz von technischen Materialien sowie von Pflanzen.			

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Synergistic insecticidal mixtures

The invention relates to synergistic insecticidal mixtures of fipronil and agonists or antagonists of nicotinic acetylcholine receptors for the protection of industrial materials,

5 It is already known that fipronil can be employed for controlling wood-damaging animals (EP-295 117; US-PS 5 232 940). The very low vapour pressure of these compounds is an advantage.

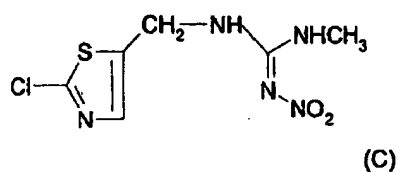
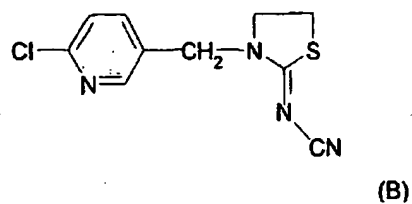
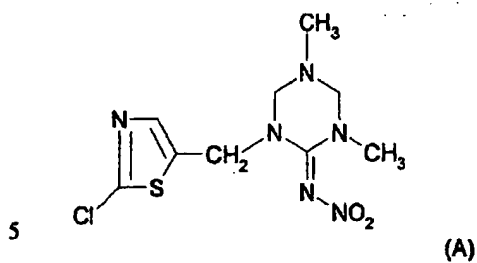
However, relatively high concentrations are required when fipronil is used on its own. It is very difficult to deliver the concentrations required for activity sufficiently deep
10 into the wood to be protected.

Furthermore, it is also known that agonists and antagonists of nicotinic acetylcholine receptors can be used for controlling insects and wood-damaging animals. Here, the active compound also has to be employed in relatively high concentrations to achieve an acute effect in the lower layers of the wood. In many instances, sub-lethal doses
15 result in a change of the behaviour of the species, but in many cases these are reversible.

It has now been found that mixtures of fipronil and at least one agonist or antagonist of acetylcholine receptors of the formula (A)-(C) have synergistic activity and are suitable for protecting industrial materials, in particular wood, against attack by insects. Owing
20 to this synergism, significantly lower amounts of active compounds can be used, i.e. the activity of the mixture is greater than the activity of the individual components.

The agonists and antagonists of the nicotinic acetylcholine receptors of the formula





are known compounds.

10

The active compound combination of fipronil and agonists and antagonists of nicotinic acetylcholine receptors of the formula (A)-(C) are very useful for protecting industrial

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(the next page is 10)

materials, in particular wood, against attack by wood-destroying insects, such as, for example,

1. Beetles

5 Hylotrupes bajulus, Chlorophorus pilosis, anabium punctatum, Xestobium rufovillosum, Ptilinus pecticornis, Dendrobium pertinet, Ernobius mollis, Priobium carpini, Lyctus brunneus, Lyctus africanus, Lyctus planicollis, Lyctus linearis, Lyctus pubescens, Trogoxylon aequale, Minthes rugicollis, Xyleborus spec. Tryptodendron spec. Apatemonachus, Bostrychus capucins, Heterobostrychus bruneus, Sinoxylon spec. Dinoderus minutus

10 2. Dermapterans

Sirex juvencus, Urocerus gigas, Urocerus gigas taignus, Urocerus augur

3. Termites

15 Kaloterms flavicollis, Cryptoterms brevis, Heteroterms indicola, Reticulitermes flavipes, Reticulitermes santonensis, Reticulitermes lucilugus, Mastoterms darwiniensis, Zootermopsis nevadensis, Coptoterms formosanus.

20 The ratio of the compounds of the formulae (A)-(C) employed and fipronil, and the total amount of the mixture, depends on the species and the occurrence of the insects. The optimum ratios and total application rates can be determined upon each use in each case by test series. In general, the ratio of the compounds of the formulae (A)-(C) and fipronil is 1:100 to 100:1; preferably 1:10 to 10:1.

In general, the active compound combinations according to the invention can be incorporated into all compositions or formulations for the protection of wood, for example by mixing the active compounds with solvent or diluent, emulsifier, dispersant and/or binder or fixative, water repellent, if appropriate desiccants and UV stabilizers



and, if appropriate, colorants and pigments and other processing auxiliaries, or as an additive to any other formulations for the protection of wood.

The solvent and/or diluent used is an organochemical solvent or solvent mixture and/or an oily or oil-type organochemical solvent or solvent mixture of low volatility and/or
5 a polar organochemical solvent or solvent mixture and/or water and at least one emulsifier and/or wetting agent or consists thereof.

Organochemical solvents which are preferably employed are oily or oil-type solvents having an evaporation number of above 35 and a flashpoint of above 30°C, preferably above 45°C. Substances which are used as such oily and oil-type solvents which have
10 low volatility and are insoluble in water are suitable mineral oils or their aromatic fractions, or mineral-oil-containing solvent mixtures, preferably white spirit, petroleum and/or alkylbenzene.

Substances which are advantageously used are mineral oils with a boiling range of 170 to 220°C, white spirit with a boiling range of 170 to 220°C, spindle oil with a boiling
15 range of 250 to 350°C, petroleum or aromatics of boiling range 160 to 280°C, essence of turpentine and the like.

In a preferred embodiment, liquid aliphatic hydrocarbons with a boiling range of 180 to 210°C or high-boiling mixtures of aromatic and aliphatic hydrocarbons with a boiling range of 180 to 220°C and/or spindle oil and/or monochloronaphthalene,
20 preferably α -monochloronaphthalene, are used.

The organic oily or oil-type solvents of low volatility having an evaporation number of above 35 and a flashpoint of above 30°C, preferably above 45°C, can be partially replaced by organochemical solvents of high or medium volatility, with the proviso that the solvent mixture also has an evaporation number of above 35 and a flashpoint of
25 above 30°C, preferably above 45°C, and that the insecticide/fungicide mixture is soluble or emulsifiable in this solvent mixture.



In a preferred embodiment, part of the organochemical solvent or solvent mixture or an aliphatic polar organochemical solvent or solvent mixture is replaced. Substances which are preferably used are aliphatic organochemical solvents having hydroxyl and/or ester and/or ether groups, such as, for example, glycol ether, esters and the like.

- 5 A particularly useful solvent/diluent is water, if appropriate as a mixture with one or more of the abovementioned organochemical solvents/diluents, emulsifiers and dispersants.

- 10 The organochemical binders used within the scope of the present invention are the synthetic resins and/or binding drying oils which are known per se and can be diluted with water and/or are soluble or dispersible or emulsifiable in the organochemical solvents employed, in particular binders composed of, or comprising, an acrylate resin, a vinyl resin, for example polyvinyl acetate, polyester resin, polycondensation or polyaddition resin, polyurethane resin, alkyd resin or modified alkyd resin, phenol resin, hydrocarbon resin, such as indene/coumarone resin, silicone resin, drying
15 vegetable and/or drying oils and/or physically drying binders based on a natural and/or synthetic resin.

- 20 The synthetic resin used as the binder can be employed in the form of an emulsion, dispersion or solution. Up to 10% by weight of bitumen or bituminous substances can also be used as binders. In addition, colorants, pigments, water repellents, odour-masking substances and inhibitors or anticorrosives known per se and the like can also be employed.

- 25 The composition or the concentrate preferably comprises, in accordance with the invention, at least one alkyd resin or modified alkyd resin and/or a drying vegetable oil as the organochemical binder. Preferably used according to the invention are alkyd resins with an oil content of over 45% by weight, preferably 50 to 68% by weight.

All or some of the abovementioned binder can be replaced by a fixative (mixture) or a plasticizer (mixture). These additives are intended to prevent volatilization of the



active compounds and crystallization or precipitation. They preferably replace 0.01 to 30% of the binder (based on 100% of the binder employed).

5 The plasticizers are from the chemical classes of the phthalic esters, such as dibutyl phthalate, dioctyl phthalate or benzylbutyl phthalate, the phosphoric esters, such as tributyl phosphate, the adipic esters, such as di-(2-ethylhexyl) adipate, the stearates, such as butyl stearate or amyl stearate, the oleates, such as butyl oleate, the glycerol ethers or relatively high-molecular-weight glycol ethers, glycerol esters and p-toluene-sulphonic esters.

10 Fixatives are chemically based on polyvinyl alkyl ethers, such as, for example, polyvinyl methyl ether, or ketones, such as benzophenone or ethylene benzophenone, amines, such as, for example, alkanolamines, such as monoethanolamine or ammonia.

15 Wood which can be protected by the active compound mixture according to the invention or compositions comprising such a mixture are to be understood as meaning, for example: construction timber, wooden beams, railway sleepers, bridge components, jetties, wooden vehicles, boxes, pallets, containers, telephone poles, wood lagging, windows and doors made of wood, plywood, particle board, joiner's articles, or wood products which, quite generally, are used in the construction of houses or in joinery.

Particularly effective protection of wood is achieved by large-scale industrial impregnation processes, for example vacuum, double-vacuum or pressure processes.

20 The insecticidal compositions or concentrates used for the protection of wood and timber products comprise the active compound combination in a concentration of 0.001 to 95% by weight, in particular 0.001 to 60% by weight.

25 Using the compositions according to the invention, it is possible to replace, in an advantageous manner, the insecticidal compositions which are currently available by more effective compositions. The compositions according to the invention exhibit good stability and have an advantageous broad insecticidal activity spectrum.



In ready-to-use applications, the mixtures according to the invention may also be present, if appropriate, as a mixture with other insecticides and, if appropriate, also with one or more fungicides in order to achieve additional activity against wood-destroying and wood-discoloring fungi. In many cases, additional synergisms are then
5 observed.

Examples of insecticides which may optionally be admixed include:

phosphoric esters, such as azinphos-ethyl, azinphos-methyl, α -1(4-chlorophenyl)-4-(O-ethyl, S-propyl)phosphoryloxy-pyrazole, chlorpyrifos, coumaphos, demeton, demeton-S-methyl, diazinone, dichlorovos, dimethoate, ethoate, ethoprophos, etrimfos, fenitrothion,
10 fenthion, heptenophas, parathion, parathion-methyl, phosalone, poxim, pirimiphos-ethyl, pirimiphos-methyl, profenofos, prothiofos, sulfprofos, triazophos and trichlorphon;
carbamates, such as aldicarb, bendiocarb, α -2-(1-methylpropyl)-phenyl methylcarbamate, butocarboxim, butoxycarboxim, carbaryl, carbofuran, carbosulfan, cloethocarb, isoprocab, methomyl, oxamyl, pirimicarb, promecarb, propoxur and
15 thiodicarb;
organosilicon compounds, preferably dimethyl(phenyl)silyl-methyl 3-phenoxybenzyl ethers, such as dimethyl-(4-ethoxyphenyl)-silylmethyl 3-phenoxybenzyl ether or (dimethylphenyl)-silyl-methyl 2-phenoxy-6-pyridylmethyl ethers such as, for example, dimethyl-(9-ethoxy-phenyl)-silylmethyl 2-phenoxy-6-pyridylmethyl ether or [(phenyl)-3-
20 (3-phenoxyphenyl)-propyl]dimethyl-silanes such as, for example, (4-ethoxyphenyl)-[3-(4-fluoro-3-phenoxyphenyl-propyl)]dimethyl-silane, silafluofen;
pyrethroids, such as allethrin, alphamethrin, bioresmethrin, byfenthrin, cycloprothrin, cyfluthrin, decamethrin, cyhalothrin, cypermethrin, deltamethrin, alpha-cyano-3-phenyl-2-methylbenzyl 2,2-dimethyl-3-(2-chloro-2-trifluoro-methylvinyl)cyclopropane-
25 carboxylate, fenpropathrin, fenfluthrin, fenvalerate, flucythrinate, flumethrin, fluvalinate, permethrin, resmethrin and tralomethrin;
nitroimines and nitromethylenes, such as 1-[(6-chloro-3-pyridinyl)-methyl]-4,5-dihydro-N-nitro-1H-imidazol-2-amine (imidacloprid), N-[(6-chloro-3-pyridyl)methyl]-N²-cyano-N¹-methylacetamide (NI-25);
30 abamectin, AC 303, 630, acephate, acrinathrin, alanycarb, aldoxycarb, aldrin, amitraz,



azamethiphos, *Bacillus thuringiensis*, phosmet, phosphamidon, phosphine, prallethrin, propaphos, propetamphos, prothoate, pyraclofos, pyrethrins, pyridaben, pyridafenthion, pyriproxyfen, quinalphos, RH-7988, rotenone, sodium fluoride, sodium hexafluorosilicate, sulfotep, sulfuryl fluoride, tar oils, teflubenzuron, tefluthrin, 5 temephos, terbufos, tetrachlorvinphos, tetramethrin, O-2-tert-butyl-pyrimidin-5-yl-o-isopropyl-phosphorothiate, thiocyclam, thiofanox, thiometon, tralomethrin, triflumuron, trimethacarb, vamidothion, *Verticillium Lacanii*, XMC, xylylcarb, benfuracarb, bensultap, bifenthrin, bioallethrin, MERbioallethrin (S)-cyclopentenyl isomer, bromophos, bromophos-ethyl, buprofezin, cadusafos, calcium polysulphide, 10 carbophenothion, cartap, quinomethionate, chlordane, chlorfenvinphos, chlorfluazuron, chlormephos, chloropicrin, chlorpyrifos, cyanophos, beta-cyfluthrin, alpha-cypermethrin, cyophenothrin, cyromazine, dazomet, DDT, demeton-S-methylsulphone, diafenthiuron, dialifos, dicrotophos, diflubenzuron, dinoseb, deoxabenzofos, diazacarb, disulfoton, DNOC, empenthrin, endosulfan, EPN, esfenvalerate, ethiofencarb, ethion, etofenprox, 15 fenobucarb, fenoxycarb, fensulfothion, fipronil, flucycloxuron, flufenprox, flufenoxuron, fonofos, formetanate, formothion, fosmethilan, furathiocarb, heptachlor, hexaflumuron, hydramethylnon, hydrogen cyanide, hydroprene, IPSP, isazofos, isofenphos, isoprothiolane, isoxathion, iodofenphos, kadethrin, lindane, malathion, mecarbam, mephosfolan, mercurous, chloride, metam, Metarthizium, anisopliae, methacrifos, 20 methamidophos, methidathion, methiocarb, methoprene, methoxychlor, methyl isothiocyanate, metholcarb, mevinphos, monocrotophos, naled, Neodiprion sertifer NPV, nicotine, omethoate, oxydemeton-methyl, pentachlorophenol, petroleum oils, phenothrin, phenthoate, phorate.

25 The other insecticides that may optionally be admixed may also be from the class of the compounds of the general formula (I).

Fungicides which may optionally be admixed are preferably:

Triazoles such as:

azaconazole, propiconazole, tebuconazole, cyproconazole, metconazole, amitrole, azocyclotin, BAS 480F, bitertanol, difenoconazole, fenbuconazole, fenchlorazole,



fenethanil, fluquinconazole, flusilazole, flutriafol, imibenconazole, isozofos, myclobutanil, paclobutrazol, (\pm)-cis-1-(4-chlorophenyl)-2-(1H-1,2,4-triazol-1-yl)-cycloheptanol, tetraconazole, triadimefon, triadimenol, triapenthenol, triflumizole, triticonazole, uniconazole and their metal salts and acid adducts.

5 **Imidazoles such as:**

imazalil, pefurazoate, prochloraz, triflumizole, 2-(1-tert-butyl)-1-(2-chlorophenyl)-3-(1,2,4-triazol-1-yl)-propan-2-ol, thiazolecarboxanilides such as 2',6'-dibromo-2-methyl-4-trifluoromethoxy-4'-trifluoromethyl-1,3-thiazole-5-carboxanilide, 1-imidazolyl-1-(4'-chlorophenoxy)-3,3-dimethylbutan-2-one and their metal salts and acid adducts.

- 10 Methyl(E)-2-[2-[6-(2-cyanophenoxy)pyrimidin-4-yloxy]phenyl]-3-methoxyacrylate, methyl(E)-2-[2-[6-(2-thioamidophenoxy)pyrimidin-4-yloxy]phenyl]-3-methoxyacrylate, methyl(E)-2-[2-[6-(2-fluorophenoxy)pyrimidin-4-yloxy]phenyl]-3-methoxyacrylate, methyl(E)-2-[2-[6-(2,6-difluorophenoxy)pyrimidin-4-yloxy]phenyl]-3-methoxyacrylate, methyl(E)-2-[2-[3-(pyrimidin-2-yloxy)phenoxy]phenyl]-3-methoxyacrylate, methyl(E)-2-[2-[3-(5-methylpyrimidin-2-yloxy)-phenoxy]phenyl]-3-methoxyacrylate, methyl(E)-2-[2-[3-(phenyl-sulphonyloxy)phenoxy]phenyl]-3-methoxyacrylate, methyl(E)-2-[2-[3-(4-nitrophenoxy)phenoxy]phenyl]-3-methoxyacrylate, methyl(E)-2-[2-phenoxyphe^{nyl}yl]-3-methoxyacrylate, methyl(E)-2-[2-(3,5-dimethylbenzoyl)pyrrol-1-yl]-3-methoxyacrylate, methyl(E)-2-[2-(3-methoxyphenoxy)phenyl]-3-methoxyacrylate, methyl(E)-2-[2-(2-phenylethen-1-yl)-phenyl]-3-methoxyacrylate, methyl(E)-2-[2-(3,5-dichlorophenoxy)pyridin-3-yl]-3-methoxyacrylate, methyl(E)-2-(2-(3-(1,1,2,2-tetrafluoroethoxy)phenoxy)phenyl)-3-methoxyacrylate, methyl(E)-2-(2-(3-(alpha-hydroxybenzyl)phenoxy)phenyl)-3-methoxyacrylate, methyl(E)-2-(2-(4-phenoxy-pyridin-2-yloxy)phenyl)-3-methoxyacrylate, methyl(E)-2-[2-(3-n-propyloxyphenoxy)phenyl]-3-methoxyacrylate, methyl(E)-2-[2-(3-isopropyloxyphenoxy)phenyl]-3-methoxyacrylate, methyl(E)-2-[2-[3-(2-fluorophenoxy)phenoxy]phenyl]-3-methoxyacrylate, methyl(E)-2-[2-(3-ethoxyphenoxy)phenyl]-3-methoxyacrylate, methyl(E)-2-[2-(4-tert-butyl-pyridin-2-yloxy)phenyl]-3-methoxyacrylate, methyl(E)-2-[2-[3-(3-cyanophenoxy)phenoxy]phenyl]-3-methoxyacrylate, methyl(E)-2-[2-[(3-methyl-
- 25
- 30



- pyridin-2-yloxymethyl)phenyl]-3-methoxyacrylate, methyl(E)-2-[2-[6-(2-methylphenoxy)pyrimidin-4-yloxy]phenyl]-3-methoxyacrylate, methyl(E)-2-[2-(5-bromopyridin-2-yloxymethyl)phenyl]-3-methoxyacrylate, methyl(E)-2-[2-(3-iodopyridin-2-yloxy)phenoxy]phenyl]-3-methoxyacrylate, methyl(E)-2-[2-[6-(2-chloropyridin-3-yloxy)pyrimidin-4-yloxy]phenyl]-3-methoxyacrylate, (E),(E)methyl-2-[2-(5,6-dimethylpyrazin-2-ylmethyloximinomethyl)phenyl]-3-methoxyacrylate, (E)-methyl-2-[2-[6-(6-methylpyridin-2-yloxy)pyrimidin-4-yloxy]phenyl]-3-methoxyacrylate, (E),(E)methyl-2-[2-(3-methoxyphenyl)methyloximinomethyl]phenyl]-3-methoxyacrylate, (E)methyl-2-[2-(6-(2-azidophenoxy)-pyrimidin-4-yloxy]phenyl]-3-methoxyacrylate, (E),(E)methyl-2-[2-[6-phenylpyrimidin-4-yl)methyloximinomethyl]phenyl]-3-methoxyacrylate, (E),(E)methyl-2-[2-[(4-chlorophenyl)methyloximinomethyl]phenyl]-3-methoxyacrylate, (E)methyl-2-[2-[6-(2-n-propylphenoxy)-1,3,5-triazin-4-yloxy]phenyl]-3-methoxyacrylate, (E),(E)methyl-2-[2-[(3-nitrophenyl)methyloximinomethyl]phenyl]-3-methoxyacrylate;
- 15 **Succinate dehydrogenase inhibitors such as:**
 fenfuram, furcarbanil, cyclofluramid, furmecyclox, seedvax, metsulfonav, pyrocarbolid, oxycarboxin, shirlan, mebenil (mepronil), benodanil, flutolanil (Moncut);
 naphthalene derivatives such as terbinafine, naftifine, butenafine, 3-chloro-7-(2-aza-2,7,7-trimethyl-oct-3-en-5-ine);
- 20 sulfenamides such as dichlofluanid, tolylfluanid, folpet, fluorfolpet; captan, captofol;
 benzimidazoles such as carbendazim, benomyl, furathiocarb, fuberidazole, thiophonate-methyl, thiabendazole or their salts;
 morpholine derivatives such as fenpropimorph, falimorph, dimethomorph, dodemorph, aldimorph, fenpropidine and their arylsulphonates, such as, for example, p-toluenesulphonic acid and p-dodecylphenyl-sulphonic acid;
- 25 dithiocarbamates, cufraneb, ferbam, mancozeb, mancozeb, maneb, metam, metiram, thiram zeneb, ziram;
 benzothiazoles, such as 2-mercaptobenzothiazole;
 benzamides, such as 2,6-dichloro-N-(4-trifluoromethylbenzyl)-benzamide;
- 30 boron compounds, such as boric acid, boric esters, borax;
 formaldehyde and formaldehyde-releasing compounds, such as benzyl alcohol



- mono(poly)-hemiformal, oxazolidine, hexa-hydro-S-triazines, N-methylolchloroacetamide, paraformaldehyde, nitropyrin, oxolinic acid, tecloftalam; tris-N-(cyclohexyldiazeniumdioxy)-aluminium, N-(cyclo-hexyldiazeniumdioxy)-tributyltin or K salts, bis-N-(cyclohexyldiazeniumdioxy)-copper, N-methylisothiazolin-3-one, 5-chloro-N-methylisothiazolin-3-one, 4,5-dichloro-N-octylisothiazolin-3-one, N-octyl-isothiazolin-3-one, 4,5-trimethylene-isothiazolinone, 4,5-benzisothiazolinone, N-methylolchloroacetamide;
- aldehydes, such as cinnamaldehyde, formaldehyde, glutaraldehyde, β -bromocinnamaldehyde;
- thiocyanates, such as thiocyanatomethylthiobenzothiazole, methylenebisthiocyanate, and the like;
- quaternary ammonium compounds, such as benzyldimethyltetradecylammonium chloride, benzyldimethyldodecylammonium chloride, didecyldimethylammonium chloride;
- iodine derivatives, such as diiodomethyl p-tolyl sulphone, 3-iodo-2-propinyl alcohol, 4-chlorophenyl-3-iodopropargyl formal, 3-bromo-2,3-diiodo-2-propenyl ethylcarbamate, 2,3,3-triiodoallyl alcohol, 3-bromo-2,3-diiodo-2-propenyl alcohol, 3-iodo-2-propinyl n-butylcarbamate, 3-iodo-2-propinyl n-hexylcarbamate, 3-iodo-2-propinyl cyclohexylcarbamate, 3-iodo-2-propinyl phenylcarbamate;
- phenol derivatives, such as tribromophenol, tetrachlorophenol, 3-methyl-4-chlorophenol, 3,5-dimethyl-4-chlorophenol, phenoxyethanol, dichlorophene, o-phenylphenol, m-phenylphenol, p-phenylphenol, 2-benzyl-4-chlorophenol and their alkali metal and alkaline earth metal salts;
- microbicides having an activated halogen group, such as chloroacetamide, bronopol, bronidox, tectamer, such as 2-bromo-2-nitro-1,3-propanediol, 2-bromo-4'-hydroxyacetophenone, 2,2-dibromo-3-nitrile-propionamide, 1,2-dibromo-2,4-dicyanobutane, β -bromo- β -nitrostyrene;
- pyridines, such as 1-hydroxy-2-pyridinethione (and their Na, Fe, Mn, Zn salts), tetrachloro-4-methylsulphonylpyridine, pyrimethanol, mepanipyrin, dipyrithion, 1-hydroxy-4-methyl-6-(2,4,4-trimethylpentyl)-2(1H)-pyridine;
- metal soaps, such as tin naphthenate, copper naphthenate, zinc naphthenate, tin octoate, copper octoate, zinc octoate, tin 2-ethylhexanoate, copper 2-ethylhexanoate, zinc 2-



- ethylhexanoate, tin oleate, copper oleate, zinc oleate, tin phosphate, copper phosphate, zinc phosphate, tin benzoate, copper benzoate and zinc benzoate;
metal salts, such as copper hydroxycarbonate, sodium dichromate, potassium dichromate, potassium chromate, copper sulphate, copper chloride, copper borate, zinc
5 fluorosilicate, copper fluorosilicate, in particular mixtures with fixatives;
oxides, such as tributyltin oxide, Cu_2O , CuO , ZnO ;
dialkyldithiocarbamates, such as Na and Zn salts of dialkyldithiocarbamates, tetramethylthiuram disulphide, potassium N-methyl-dithiocarbamate;
nitriles, such as 2,4,5,6-tetrachloroisophthalodinitrile, disodium cyano-
10 dithioimidocarbamate;
quinolines, such as 8-hydroxyquinoline, and their Cu salts;
mucochloric acid, 5-hydroxy-2(5H)-furanone;
4,5-dichlorodithiazolinone, 4,5-benzodithiazolinone, 4,5-trimethylenedithiazolinone, 4,5-dichloro-(3H)-1,2-dithiol-3-one, 3,5-dimethyl-tetrahydro-1,3,5-thiadiazine-2-thione, N-
15 (2-p-chlorobenzoyl-ethyl)-hexaminium chloride, potassium N-hydroxymethyl-N'-methyl-dithiocarbamate,
2-oxo-2-(4-hydroxy-phenyl)acetohydroxamic acid chloride,
phenyl-(2-chloro-cyano-vinyl)sulphone,
phenyl-(1,2-dichloro-2-cyano-vinyl)sulphone;
20 Ag, Zn or Cu-containing zeolites, alone or enclosed in polymeric active compounds, or else mixtures of more than one of the abovementioned fungicides.

- As already mentioned, the active compound mixtures are suitable for controlling animal pests, in particular insects, arachnids and nematodes, encountered in agriculture, in forests, in the protection of stored products, and in the hygiene field, and have good
25 plant tolerance and favourable toxicity to warm-blooded animals. They are active against normally sensitive and resistant species and against all or some stages of development. The abovementioned pests include:

- From the order of the Isopoda, for example, *Oniscus asellus*, *Armadillidium vulgare* and *Porcellio scaber*.
30 From the order of the Diplopoda, for example, *Blaniulus guttulatus*.



- From the order of the Chilopoda, for example, *Geophilus carpophagus* and *Scutigera spec.*
- From the order of the Symphyla, for example, *Scutigera immaculata*.
- From the order of the Thysanura, for example, *Lepisma saccharina*.
- 5 From the order of the Collembola, for example, *Onychiurus armatus*.
- From the order of the Orthoptera, for example, *Blatta orientalis*, *Periplaneta americana*, *Leucophaea maderae*, *Blattella germanica*, *Acheta domesticus*, *Gryllotalpa* spp., *Locusta migratoria migratorioides*, *Melanoplus differentialis* and *Schistocerca gregaria*.
- From the order of the Dermaptera, for example, *Forficula auricularia*.
- 10 From the order of the Isoptera, for example, *Reticulitermes* spp.
- From the order of the Anoplura, for example, *Pediculus humanus corporis*, *Haematopinus* spp. and *Linognathus* spp.
- From the order of the Mallophaga, for example, *Trichodectes* spp. and *Damalinea* spp.
- From the order of the Thysanoptera, for example, *Hercinothrips femoralis* and *Thrips tabaci*.
- 15 From the order of the Heteroptera, for example, *Eurygaster* spp., *Dysdercus intermedius*, *Piesma quadrata*, *Cimex lectularius*, *Rhodnius prolixus* and *Triatoma* spp.
- From the order of the Homoptera, for example, *Aleurodes brassicae*, *Bemisia tabaci*, *Trialeurodes vaporariorum*, *Aphis gossypii*, *Brevicoryne brassicae*, *Cryptomyzus ribis*,
- 20 *Doralis fabae*, *Doralis pomi*, *Eriosoma lanigerum*, *Hyalopterus arundinis*, *Macrosiphum avenae*, *Myzus* spp., *Phorodon humuli*, *Rhopalosiphum padi*, *Phylloxera vastatrix*, *Pemphigus* spp., *Empoasca* spp., *Euscelis bilobatus*, *Nephotettix cincticeps*, *Lecanium corni*, *Saissetia oleae*, *Laodelphax striatellus*, *Nilaparvata lugens*, *Aonidiella aurantii*, *Aspidiotus hederae*, *Pseudococcus* spp. and *Psylla* spp.
- 25 From the order of the Lepidoptera, for example, *Pectinophora gossypiella*, *Bupalus piniarius*, *Cheimatobia brumata*, *Lithocolletis blancardella*, *Hyponomeuta padella*, *Plutella maculipennis*, *Malacosoma neustria*, *Euproctis chrysorrhoea*, *Lymantria* spp., *Bucculatrix thurberiella*, *Phyllocnistis citrella*, *Agrotis* spp., *Euxoa* spp., *Feltia* spp., *Earias insulana*, *Heliothis* spp., *Laphygma exigua*, *Mamestra brassicae*, *Panolis flammea*, *Prodenia litura*, *Spodoptera* spp., *Trichoplusia ni*, *Carpocapsa pomonella*,
- 30 *Pieris* spp., *Chilo* spp., *Pyrausta nubilalis*, *Ephestia kuehniella*, *Galleria mellonella*,



Tineola bisselliella, *Tinea pellionella*, *Hofmannophila pseudospretella*, *Cacoecia podana*, *Capua reticulana*, *Choristoneura fumiferana*, *Clysia ambiguella*, *Homona magnanima* and *Tortrix viridana*.

From the order of the Coleoptera, for example, *Anobium punctatum*, *Rhizopertha dominica*, *Bruchidius obtectus*, *Acanthoscelides obtectus*, *Hylotrupes bajulus*, *Agelastica alni*, *Leptinotarsa decemlineata*, *Phaedon cochleariae*, *Diabrotica* spp., *Psylliodes chrysocephala*, *Epilachna varivestis*, *Atomaria* spp., *Oryzaephilus surinamensis*, *Anthonomus* spp., *Sitophilus* spp., *Otiorrhynchus sulcatus*, *Cosmopolites sordidus*, *Ceuthorrhynchus assimilis*, *Hypera postica*, *Dermestes* spp., *Trogoderma* spp.,
5 *Anthrenus* spp., *Attagenus* spp., *Lyctus* spp., *Meligethes aeneus*, *Ptinus* spp., *Niptus hololeucus*, *Gibbium psyllodes*, *Tribolium* spp., *Tenebrio molitor*, *Agriotes* spp.,
10 *Conoderus* spp., *Melolontha melolontha*, *Amphimallon solstitialis* and *Costelytra zealandica*.

From the order of the Hymenoptera, for example, *Diprion* spp., *Hoplocampa* spp.,
15 *Lasius* spp., *Monomorium pharaonis* and *Vespa* spp.

From the order of the Diptera, for example, *Aedes* spp., *Anopheles* spp., *Culex* spp., *Drosophila melanogaster*, *Musca* spp., *Fannia* spp., *Calliphora erythrocephala*, *Lucilia* spp., *Chrysomya* spp., *Cuterebra* spp., *Gastrophilus* spp., *Hyppobosca* spp., *Stomoxys* spp., *Oestrus* spp., *Hypoderma* spp., *Tabanus* spp., *Tannia* spp., *Bibio hortulanus*,
20 *Oscinella frit*, *Phorbia* spp., *Pegomyia hyoscyami*, *Ceratitis capitata*, *Dacus oleae* and *Tipula paludosa*.

From the order of the Siphonaptera, for example, *Xenopsylla cheopis* and *Ceratophyllus* spp.

From the order of the Arachnida, for example, *Scorpio maurus* and *Latrodectus mactans*.
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From the order of the Acarina, for example, *Acarus siro*, *Argas* spp., *Ornithodoros* spp., *Dermanyssus gallinae*, *Eriophyes ribis*, *Phyllocoptruta oleivora*, *Boophilus* spp., *Rhipicephalus* spp., *Amblyomma* spp., *Hyalomma* spp., *Ixodes* spp., *Psoroptes* spp., *Chorioptes* spp., *Sarcoptes* spp., *Tarsonemus* spp., *Bryobia praetiosa*, *Panonychus* spp.,
30 *Tetranychus* spp.

The plant-parasitic nematodes include *Pratylenchus* spp., *Radopholus similis*,



Ditylenchus dipsaci, Tylenchulus semipenetrans, Heterodera spp., Meloidogyne spp., Aphelenchoides spp., Longidorus spp., Xiphinema spp. and Trichodorus spp.

5 The active compound mixtures according to the invention can be present in their commercially available formulations and in use forms prepared from these formulations, as a mixture with other active compounds, such as insecticides, attractants, sterilizing agents, acaricides, nematocides, fungicides, growth-regulating substances or herbicides. The insecticides include, for example, phosphates, carbamates, carboxylates, chlorinated hydrocarbons, phenylureas and substances produced by microorganisms, inter alia. Specific examples of mixing partners include the
10 insecticides and fungicides mentioned further above.

The active compound content of the use forms prepared from the commercially available formulations can vary within wide limits. The active compound concentration of the use forms can be from 0.0000001 to 95% by weight of active compound, preferably between 0.0001 and 1% by weight.

15 The active compound mixtures can be converted into the customary formulations, such as solutions, emulsions, suspensions, powders, foams, pastes, granules, aerosols, active-compound-impregnated natural and synthetic materials, very fine encapsulations in polymeric substances and in coating compositions for seed, furthermore in formulations with smokes, such as fumigating cartridges, fumigating cans, fumigating coils and the
20 like, and also ULV cold mist and warm mist formulations.

25 These formulations are prepared in a known manner, for example by mixing the active compounds with extenders, that is, liquid solvents, pressurized liquefied gases and/or solid carriers, optionally with the use of surfactants, that is, emulsifiers and/or dispersing agents, and/or foam-formers. If the extender used is water, it is also possible to use for example organic solvents as auxiliary solvents. Suitable liquid solvents are essentially: aromatics, such as xylene, toluene or alkyl-naphthalenes, chlorinated aromatics or chlorinated aliphatic hydrocarbons, such as chlorobenzenes, chloroethylenes or methylene chloride, aliphatic hydrocarbons, such as cyclohexane or



paraffins, for example mineral oil fractions, alcohols, such as butanol or glycol and also their ethers and esters, ketones, such as acetone, methyl ethyl ketone, methyl isobutyl ketone or cyclohexanone, strongly polar solvents, such as dimethylformamide and dimethyl sulphoxide, and also water; by liquefied gaseous extenders or carriers are
5 meant liquids which are gaseous at ambient temperature and under atmospheric pressure, for example aerosol propellant, such as halogenated hydrocarbons and also butane, propane, nitrogen and carbon dioxide; suitable solid carriers are: for example, ground natural minerals, such as kaolins, clays, talc, chalk, quartz, attapulgit, montmorillonite or diatomaceous earth, and ground synthetic minerals, such as finely
10 divided silica, alumina and silicates; suitable solid carriers for granules are: for example, crushed and fractionated natural rocks such as calcite, marble, pumice, sepiolite and dolomite, and also synthetic granules of inorganic and organic meals, and granules of organic material such as sawdust, coconut shells, maize cobs and tobacco stalks; suitable emulsifiers and/or foam-formers are: for example, nonionic and anionic
15 emulsifiers, such as polyoxyethylene fatty acid esters, polyoxyethylene fatty alcohol ethers, for example alkylaryl polyglycol ethers, alkylsulphonates, alkyl sulphates, arylsulphonates and also protein hydrolysates; suitable dispersing agents are: for example, lignin-sulphite waste liquors and methylcellulose.

Tackifiers such as carboxy-methylcellulose and natural and synthetic polymers in the
20 form of powders, granules or latices, such as gum arabic, polyvinyl alcohol and polyvinyl acetate, and also natural phospholipids, such as cephalins and lecithins, and synthetic phospholipids, can be used in the formulations. Other possible additives are mineral and vegetable oils.

It is possible to use colorants such as inorganic pigments, for example iron oxide,
25 titanium oxide and Prussian Blue, and organic dyestuffs, such as alizarin dyestuffs, azo dyestuffs and metal phthalocyanine dyestuffs, and trace nutrients such as salts of iron, manganese, boron, copper, cobalt, molybdenum and zinc.

The formulations in general comprise between 0.1 and 95 per cent by weight of active compound composition, preferably between 0.5 and 90 per cent by weight of active



compound composition.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or group of integers or steps but not the exclusion of any other integer or group of integers or steps.

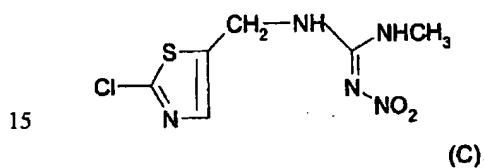
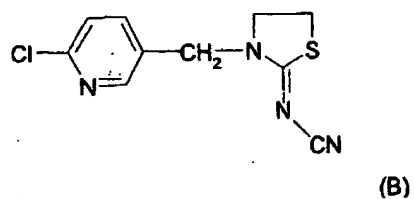
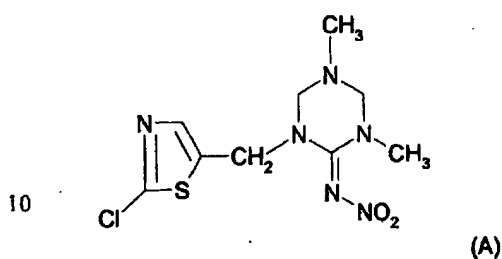


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The claims defining the invention are as follows:

1. Compositions for the protection of industrial materials comprising a synergistically effective amount of fipronil and at least one compound of the formulae (A)-(C).

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2. Composition according to claim 1, comprising fipronil and at least one compound of the formulae (A)-(C) in a ratio of 1:100 to 100:1.
3. Method for the protection of wood, characterized in that compositions according to claim 1 or claim 2 together with customary components of compositions for the protection of wood and, optionally, further active compounds are applied onto the wood to be protected, or the wood is treated with this mixture.
4. Method for the protection of industrial materials against insecticidal attack, characterized in that compositions according to claim 1 or claim 2 are applied onto the materials to be protected, or the materials are treated with this mixture.

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5. Process for preparing compositions for the protection of wood, characterized in that mixtures according to claim 1 or claim 2 are mixed with customary components of compositions for the protection of wood and, optionally further active compounds.
- 5 6. Compositions according to claim 1 or claim 2, processes for their preparation or methods of protection involving containing them, substantially as hereinbefore described with reference to the Examples.

DATED this 10th day of May, 2000

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BAYER AG

By its Patent Attorneys

DAVIES COLLISON CAVE

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